

FermiGrid School

FermiGrid 201

Scripting and running Grid Jobs

Course Outline

- Introduction and Conventions
- Authorization and Credentials (Lab 1)
- Grid Submission: globus-job-run and globus-url-copy (Lab 2)
- Grid Submission: condor_submit, condor_q (Lab 3)
- Submitting jobs to FermiGrid and Open Science Grid (Lab 4)
- Advanced Topics (Lab 5)
 - Globus RSL
 - DAGman
 - DOEGrids certificates
 - Problem Diagnosis
 - Globus Web Services

Introduction

- Start with simple examples that work
 - Go back to show extra tricks often used in production.
- This course will cover examples of submitting jobs from client machine fnpcsrv1 to compute resource fngp-osg.
- By the end of this course you should be able to:
 - Submit a simple job to the grid
 - Submit a complex job to the grid
 - Transfer files to the grid resource
- The examples used here should be good on any Open Science Grid site
 - Introductory material on using other sites included in Lab 4.
- You could install your own client on your own machine—Covered in FermiGrid 401.
- Ask lots of questions—we will fill them in and add them to the course in future..

Conventions

- In each section we will cover:
 - What we want to do in plain English
 - Technical tools and concepts that help us get it done
 - *TLA, ETLA, and Jargon* that needs to be defined
 - Overview of **what to type**
 - Hands-on lab with step by step **commands** and **expected output**.
 - ☺ *Tricky tips for experts*
 - ☠ Common pitfalls

How To Get Authorized to Run Jobs

- Get the client authorization and job submission software.
 - The Open Science Grid (*OSG*) Client software from the Virtual Data Toolkit (*VDT*) is already installed on fnpcsrv1
- Get a certificate to authenticate yourself
 - All Fermilab staff already have an *X.509 certificate* from the Kerberos Certificate Authority (*KCA*)
- Become a part of an authorized grid organization.
 - All Fermilab staff and users are part of the Fermilab Virtual Organization (VO) automatically
- Find a computing facility where that organization can run
 - *FermiGrid* accepts jobs from all VO's in OSG.

Term Definitions

- **OSG**: Open Science Grid: <http://www.opensciencegrid.org/>
 - 72 sites mostly in the United States who share compute and storage resources with each other. Three of those sites are here at Fermilab.
- **VDT**: Virtual Data Toolkit <http://vdt.cs.wisc.edu/>
 - OSG-funded collection of all software needed to run on the grid. Three subsets:
 - Compute Element (**CE**): Software needed to set up a server to accept grid jobs.
 - Worker Node Client: Software available on all worker nodes of any OSG site.
 - Client: Software that is needed to submit jobs.
- **Globus Toolkit** <http://www.globus.org/>
 - A wide set of services for grid job submissions, file transfer and more.
 - Included as part of the VDT
- **VO**: Virtual Organization
 - A dynamic collection of Users, Resources, and Services for sharing of Resources.
 - Examples at Fermilab: CDF, Dzero, CMS, ILC, SDSS, DES, Fermilab

Term Definitions 2

- **CA:** Certificate Authority
 - An entity that issues certificates.
- **KCA:** Kerberos Certificate Authority
 - A server that takes your Kerberos credential and issues a X.509 Certificate. Fermilab has the only one in production.
- **X.509 Certificate:**
 - Digitally signed statement from one entity (**CA**) saying that the public key of another entity (user) is valid. Follows the X.509 standard.
 - X.509 certificates are used to encrypt all authentication sessions for job submission and file transfer.
- **Proxy**
 - A short-lived self-contained representation of your certificate which can be used to submit jobs to the grid

How to Make Credentials for Job Submission

- On your desktop machine, get a kerberos credential
 - **kinit -r 168h <username>@FNAL.GOV**
- Log into a machine that has the client software on it:
 - **ssh -l <username> fnpcsrv1.fnal.gov**
- Source the setup file
 - **source /usr/local/vdt/setup.sh**
- Obtain a Fermilab KCA certificate
 - **kx509**
 - **kxlist -p**
- Get the certificate signed by the Fermilab **VOMS** server
 - **voms-proxy-init -noregen -voms fermilab:/fermilab**
- Verify that the voms-proxy-init worked
 - **voms-proxy-info -all**
- In the next slides and Lab 1 we will go through all of these steps one by one and explain the options and the intermediate results.

Preparing to submit—sample output

```
bash-3.00$ source /usr/local/vdt/setup.sh
bash-3.00$ kx509
bash-3.00$ kxlist -p
Service kx509/certificate
  issuer= /DC=gov/DC=fnal/O=Fermilab/OU=Certificate Authorities/CN=Kerberized CA
  subject= /DC=gov/DC=fnal/O=Fermilab/OU=People/CN=Steven C. Timm/UID=timmm
  serial=7E6C63
  hash=03c202fc
bash-3.00$ voms-proxy-init -noregen -voms fermilab:/fermilab
Cannot find file or dir: /home/condor/execute/dir_11128/userdir/glite/etc/vomses
Your identity: /DC=gov/DC=fnal/O=Fermilab/OU=People/CN=Steven C. Timm/USERID=timmm
Cannot find file or dir: /home/condor/execute/dir_11128/userdir/glite/etc/vomses
Contacting voms.fnal.gov:15001
[/DC=org/DC=doegrids/OU=Services/CN=http/voms.fnal.gov] "fermilab" Done
Creating proxy ..... Done
Your proxy is valid until Tue Feb 26 07:41:27 2008
```

- Comments—The warning about missing /home/condor directory is routine
- -voms fermilab:/fermilab is a Fully Qualified Attribute Name (**FQAN**), see handout for details

How did you know it worked?

```
bash-3.00$ voms-proxy-info -all
WARNING: Unable to verify signature! Server certificate possibly not installed.
Error: Cannot find certificate of AC issuer for vo fermilab
subject      : /DC=gov/DC=fnal/O=Fermilab/OU=People/CN=Steven C.
Timm/USERID=timmm/CN=proxy
issuer       : /DC=gov/DC=fnal/O=Fermilab/OU=People/CN=Steven C. Timm/USERID=timmm
identity     : /DC=gov/DC=fnal/O=Fermilab/OU=People/CN=Steven C. Timm/USERID=timmm
type         : proxy
strength     : 512 bits
path         : /tmp/x509up_u2904
timeleft     : 10:41:35
=== VO fermilab extension information ===
VO           : fermilab
subject      : /DC=gov/DC=fnal/O=Fermilab/OU=People/CN=Steven C. Timm/USERID=timmm
issuer       : /DC=org/DC=doegrids/OU=Services/CN=http/voms.fnal.gov
attribute    : /fermilab/Role=NULL/Capability=NULL
timeleft     : 10:41:35
```

Error message about “cannot find certificate” can be ignored

Why doesn't voms-proxy-init work?

```
bash-3.00$ voms-proxy-init -noregen -voms cms:/cms
Cannot find file or dir: /home/condor/execute/dir_11128/userdir/glite/etc/vomses
Your identity: /DC=gov/DC=fnal/O=Fermilab/OU=People/CN=Steven C. Timm/USERID=timmm
Cannot find file or dir: /home/condor/execute/dir_11128/userdir/glite/etc/vomses
Contacting lcg-voms.cern.ch:15002 [/DC=ch/DC=cern/OU=computers/CN=lcg-
voms.cern.ch] "cms" Failed
Error: cms: User unknown to this VO.
Trying next server for cms.
Contacting voms.cern.ch:15002 [/DC=ch/DC=cern/OU=computers/CN=voms.cern.ch]
"cms" Failed
Error: cms: User unknown to this VO.
None of the contacted servers for cms were capable
of returning a valid AC for the user.
```

- You might not be a member of the VO (see error message above)
- You might be requesting a role that you aren't authorized to be.
- Check by going to **VOMS** server <https://voms.fnal.gov:8443/voms/fermilab>
- **voms-proxy-init -debug** is your friend (Could be missing a vomses file.)
- To join a VO that you're not in now, use **VOMRS** to request membership.
- **VOMS** server might be down.

Term Definitions 3

- **VOMS**—Virtual Organization Management Service
 - All Virtual Organizations use this to certify that a member is part of their VO and has certain rights and privileges
- **VOMRS**—Virtual Organization Membership Registration Service
 - A frontend to VOMS that handles policy signing, expirations, adding extra certificates, group and role management, and more.
- **FQAN**—Fully Qualified Attribute Name
 - The combination of group and role for the user

Authorization and Credentials: Lab 1

- See the handout for Lab 1.
- Use the `kx509/kxlist -p /voms-proxy-init` sequence to get a good voms proxy.
- Show the instructor when you think you have correct output of `voms-proxy-info -all`.
- Try the other examples after section A and B if you have more time and are waiting for others.

Grid job submission in English

- There is a submission machine and a compute element (*CE*).
 - In this example, fnpcsrv1=submission machine, fngp-osg=compute element
- Client side authenticates to the compute resource
 - Using your certificate and the machine's certificate to make a SSL connection
- The executable and input files are transferred to the compute resource
 - By opening an https: connection
- The executable is submitted to the batch system on the compute resource
 - Using the *GRAM* interface
- When the job completes, the output files are transferred back.
 - Again using an https: port
- *GRAM*=Globus Resource Access Manager

Test submit: Globus-job-run

- Example
 - `globus-job-run fngp-osg.fnal.gov:2119/jobmanager-fork /usr/bin/id`
- Structure of the example:
 - Host:port to submit the job to.
 - 2119 is the default port and can be omitted
 - Which jobmanager to use?
 - Jobmanager-fork is the default. This runs jobs directly on the CE.
Production jobs should be jobmanager-condor or jobmanager-pbs.
 - Command to use
 - This example will run the /usr/bin/id that's already on the remote machine.
- Comments
 - Globus-job-run should be used only for diagnostic purposes
 - One daemon per globus-job-run is launched on the remote machine and stays running until it exits—or sometimes hangs.

Test transfer: globus-url-copy

- Globus-url-copy is the command-line client for GRIDFTP
- Example:
 - **globus-url-copy file://\${HOME}/fermigrid201/lab2/foo \gsiftp://fngp-osg.fnal.gov/grid/data/foo.\${USER}**
- Comments:
 - Globus-url-copy is for small files and light testing
 - Can be used for big files too, but with a management software like srmcp.
 - In the above example, the environment variables are evaluated on submit machine
 - Works to go to compute elements or storage elements

Grid Submission: globus-job-run and globus-url-copy

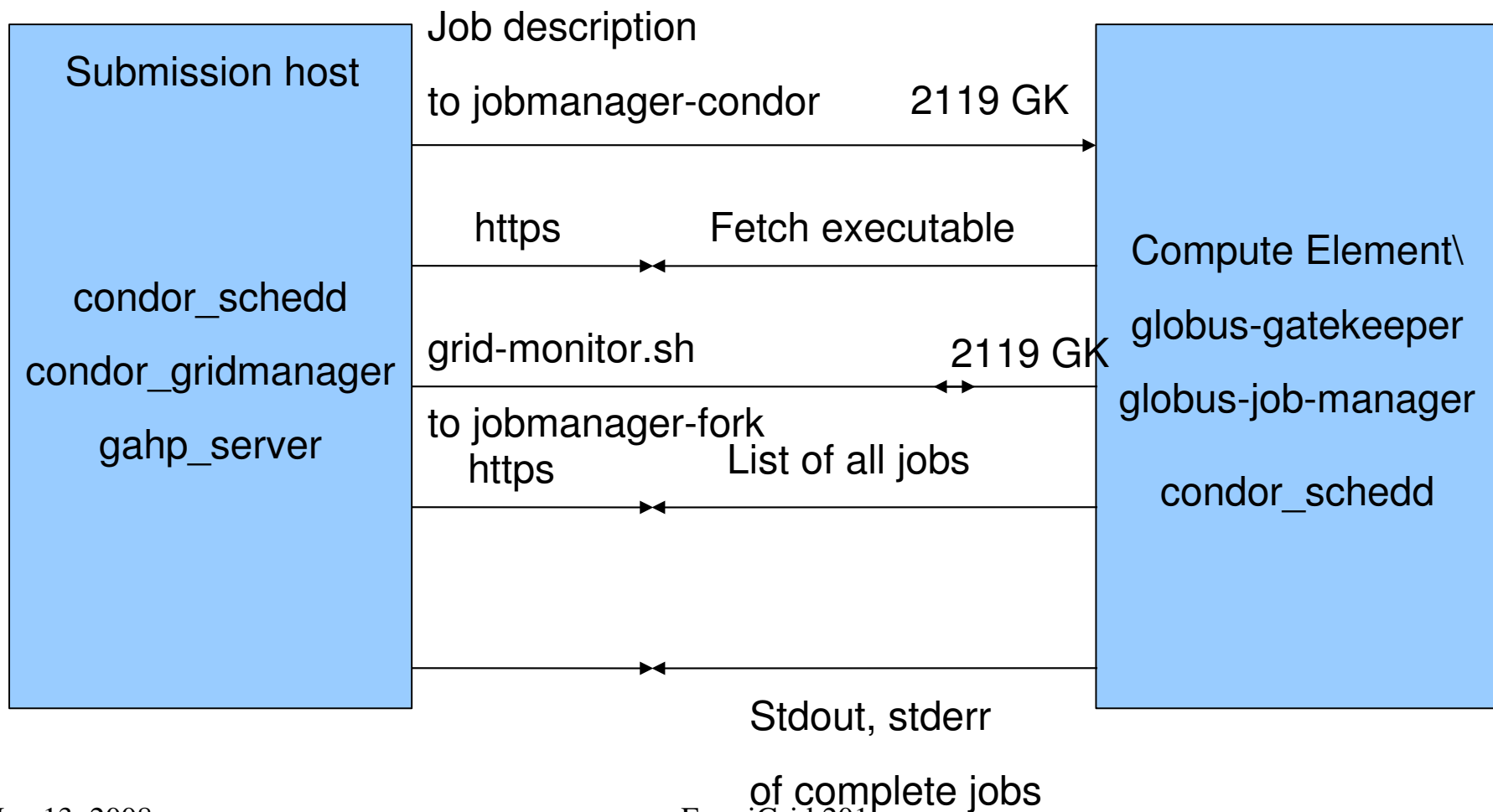
Lab 2

- Execute the following sequence:
- `globus-job-run fngp-osg.fnal.gov:2119/jobmanager-fork /usr/bin/id`
- `globus-url-copy file://${HOME}/fermigrd201/lab2/helloworld.sh gsiftp://fngp-osg.fnal.gov/grid/data/helloworld.sh.${USER}`
- `globus-job-run fngp-osg.fnal.gov:2119/jobmanager-fork /bin/chmod 755 \`
`/grid/data/helloworld.sh.${USER}`
- `globus-job-run fngp-osg.fnal.gov:2119/jobmanager-fork \`
`/grid/data/helloworld.sh.${USER}`

Condor submission concepts in English

- Condor is comprehensive batch system and grid submission software
- Grid submission client components are called Condor-G
- Have to install all of Condor to use the Condor-G clients.
- Condor-G runs on the submission host and
 - Transfers your executable and input files to remote compute element and gets it started
 - Monitors the status of the job every minute to see if it is done
 - Transfers the files back when the job is over.
- On the client machine, the `condor_schedd` keeps track of all jobs and spawns a `condor_gridmanager` to send the jobs to the grid

Condor-G Job Submission



Condor submission—simple example

```
universe = grid
GridResource = gt2 fngp-
osg.fnal.gov/jobmanager-condor
executable = recon1
transfer_output = true
transfer_error = true
transfer_executable = true
stream_output = false
stream_error = false
log = grid_recon1.log.$(Cluster).$(Process)
notification = NEVER
output=grid_recon1.out.$(Cluster).$(Process)
error = grid_recon1.err.$(Cluster).$(Process)
globusrs1 = (jobtype=single)(maxwalltime=999)
queue
```

Grid universe for all jobs

type gt2 refers to version 2 of Globus

recon1 is a binary that will run for 3 minutes

Annotated version in the examples

To submit it:

```
condor_submit grid_recon1
```

Transferring input and output files

```
bash-3.00$ more fngp-osg-gridsleep-fourargs
Universe = grid
remote_initialdir = /grid/data/foo
GridResource = gt2 fngp-osg/jobmanager-condor
executable = gridsleep.sh
# Old style of condor arguments
arguments = one two three four
transfer_output = true
transfer_error = true
transfer_executable = true
stream_output = False
stream_error = False
should_transfer_files = YES
when_to_transfer_output = ON_EXIT_OR_EVICT
transfer_input_files = foo
transfer_output_files = bar
log = gridsleep.log.$(Cluster).$(Process)
notification = NEVER
output = gridsleep.out.$(Cluster).$(Process)
error = gridsleep.err.$(Cluster).$(Process)
globusurl = (condorsubmit=(requirements
'Disk>5000'))
queue 1
```

condor_q and condor_q -globus

```
[root@fnpcsrv1 ~]# condor_q timm
ID          OWNER          SUBMITTED      RUN_TIME ST PRI SIZE CMD
1704117.0   timm              3/16 21:13    0+00:00:00 I  0   0.0  gridsleep_files.sh
[root@fnpcsrv1 ~]# condor_q -globus timm
ID          OWNER          STATUS  MANAGER  HOST                      EXECUTABLE
1704117.0   timm          UNSUBMITTED condor    fermigrid1.fnal.go /home/timm/gridsle
[root@fnpcsrv1 ~]# condor_q -globus timm
ID          OWNER          STATUS  MANAGER  HOST                      EXECUTABLE
1704117.0   timm          PENDING  condor    fermigrid1.fnal.go /home/timm/gridsle
[root@fnpcsrv1 ~]# condor_q -globus timm
ID          OWNER          STATUS  MANAGER  HOST                      EXECUTABLE
1704117.0   timm          ACTIVE   condor    fermigrid.fnal.go /home/timm/gridsleep
```

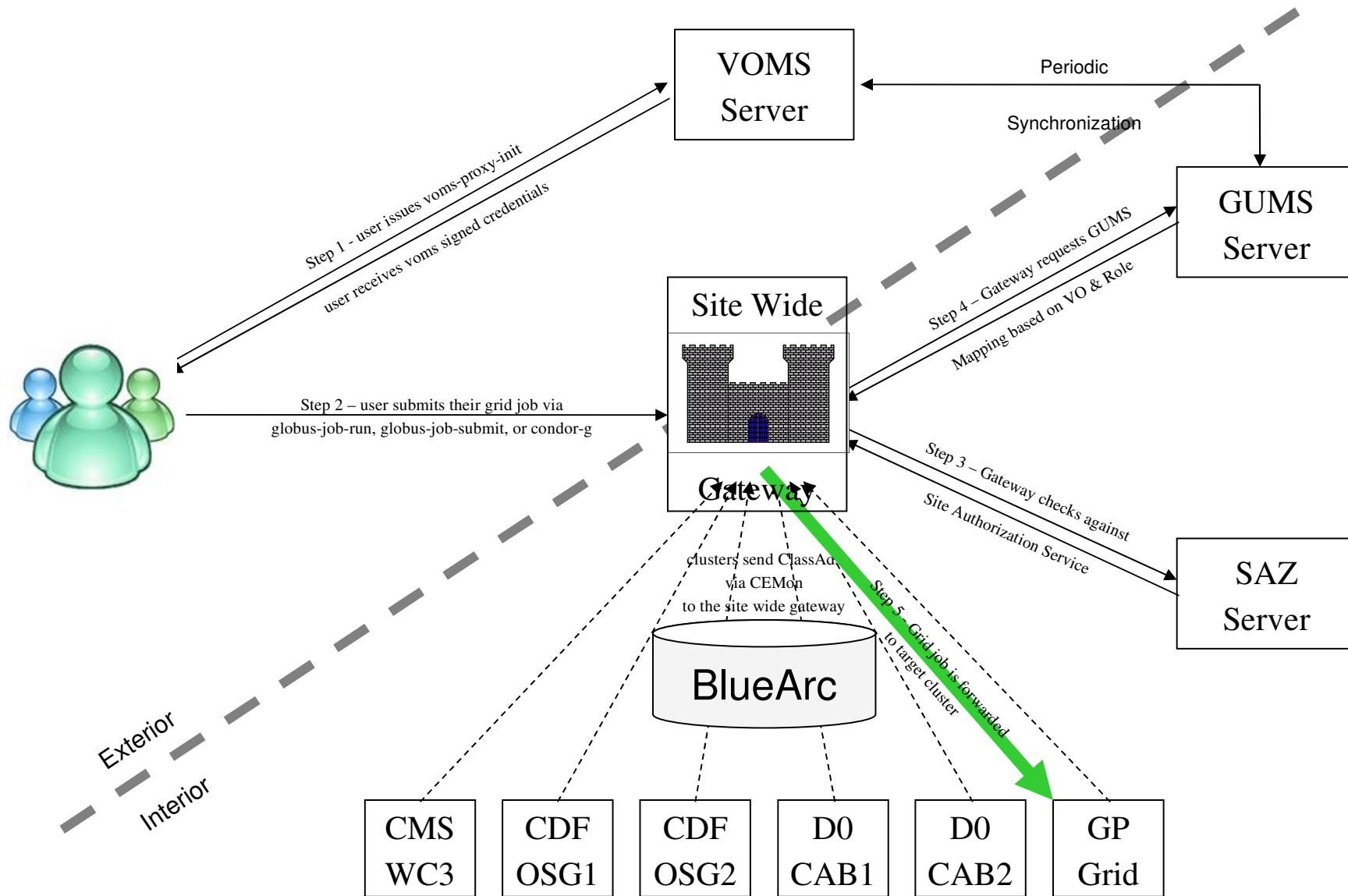
Condor_q -globus shows the status of the job as it moves through the grid.

Shows “ACTIVE” once the job starts running remotely.

Grid Submission: condor_submit--Lab 3

- Submit the jobs `grid_recon1` and `fngp-osg-gridsleep-fourargs`
- Monitor their progress with `condor_q` and `condor_q -globus`
- Record any errors
- Warning—if you modify an executable file of the same name and submit it again while the jobs with the original executable are still in the system, the original executable will still be cached in the system and used. This is a “feature”.

FermiGrid - Current Architecture



Data movement on FermiGrid

- Most grid sites have a disk area for applications, where certain users are allowed to install application software.
 - On FermiGrid this area (\$OSG_APP) is /grid/app, NFS mounted from Bluearc to all GP, CDF, D0 clusters
- Most grid sites have a disk area for data, where users are allowed to put data so that it is accessible to worker nodes
 - On FermiGrid this area (\$OSG_DATA) is /grid/data, NFS mounted from Bluearc to all GP, CDF, D0 clusters.
- Many grid sites also have an SRM-based Storage Element
 - (see this afternoon's class FermiGrid 202 for details)
 - Fermilab's is srm://fndca1.fnal.gov:8443/
- There is also a scratch area per job (\$OSG_WN_TMP) on local worker node disk.
 - On FermiGrid this directory is usually /local/stage1—but see the examples for detecting it correctly every time.

Discovering compute resources and directories, OSG

- Look them up in advance via **VORS** <http://vors.grid.iu.edu/>
 - **VORS**=Virtual Organization Resource selector
- Or detect them in your job when you get there
- FermiGrid also has regular testing for sites that accept the Fermilab VO at
<http://fermigrid.fnal.gov/monitor/fermigrid0-fermilab-vo-production-monitor-summary.html>
- Two alternate data flow models
 - Push files to /grid/data in advance of the job
 - Get to the worker node and pull files there, once you get there.

Data Flow Models

Push Model

Find \$DATA
from VORS

Copy data to
remote site \$DATA

Analyze data from
\$DATA

Copy results back
from remote \$DATA

Pull model

Submit job, it
starts running on WN

Source OSG_GRID/setup.sh
to find \$DATA and \$WN_TMP

Pull data straight to
worker node disk

Push result from worker
straight to remote site

FermiGrid and OSG, Lab 4

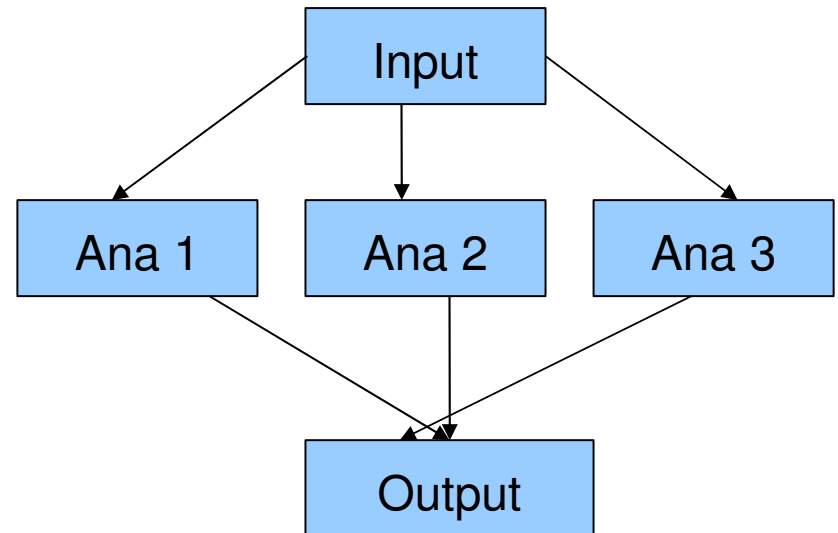
- Submit sample single job from tarball that auto-detects OSG_DATA and OSG_APP and OSG_WN_TMP, and uses them.
- Go to VORS and FermiGrid and find the information for one other OSG site.
- Modify the submit file to send the test job to that OSG site instead.

Globus RSL

- *RSL*=Resource Specification Language
- The way to communicate requirements to the remote batch system
- Can be used to set memory, wall time, processor type, architecture, and more. We have examples
<http://fermigrid.fnal.gov/gpgrid/examples>
- `jobtype=single`—needed for most PBS sites, can use anywhere
- `queue=xxxxx`—needed for most PBS sites

Condor DAGman

- DAG=Directed Acyclic Graph
- Used to show dependencies—to make one job not start until its predecessor is completed.
- Example is provided in the example tarball, we will go through it if we have time
- Pegasus as automated DAG maker
- **condor_submit_dag ex2.dag**



Using DOEGrids Certificates

- Why get a DOEGrids cert? (see <http://security.fnal.gov/pki> for full explanation)
 - More widely accepted
 - Can load into browser long term
 - Can use to sign E-mail
- Store your DOEGrids cert and private key—on some non-network-mounted disk.
- If a certificate is compromised, you revoke it by contacting DOEGrids.
- Open Science Enclave policy requires you protect cert and proxy.

Monitoring of Grid Jobs

- Globus GRAM is meant to hide the remote batch system details from the submitting host. It is **very** good at this.
- condor_q
- condor_q -globus
- condor_q -held
- Userlog
- CondorView
- Remote condor_q
 - condor_q -name fngp-osg -pool fnpcsrv2
 - condor_q -name fcdfosg2 -pool fcdfcm2
 - condor_q -name cmsosgce3 -pool cmssrv14.fnal.gov

condor_q -held

```
[root@fnpcsrv1 ~]# condor_q -held
```

ID	OWNER	HELD_SINCE	HOLD_REASON
1674997.0	greenc	3/11 09:35	Globus error 12: the connection to the serv
1702530.9	carneiro	3/15 02:12	Globus error 131: the user proxy expired(j
1703617.0	rubin	3/15 16:29	Globus error 5: the executable does not exi
1703626.0	rubin	3/15 17:21	Globus error 10: data transfer to the serve
1703631.0	rubin	3/15 17:22	Globus error 3: an I/O operation failed

Condor_q -held tells you when the job was held, and why.

First thing to try is to **condor_release** the job

To remove, first **condor_rm**,

If that doesn't work, **condor_rm -forcex**.

Condor Userlog

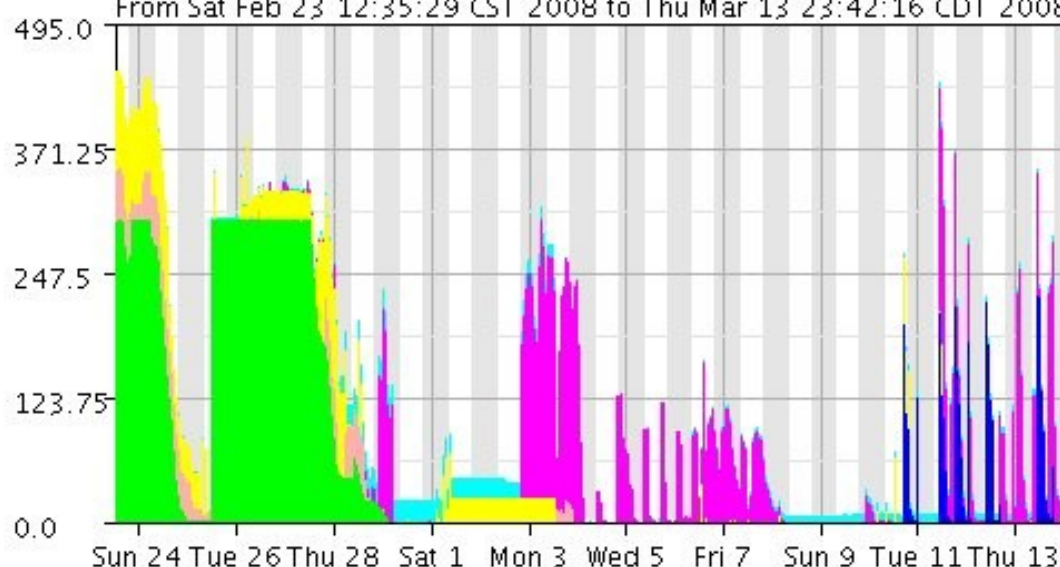
To contact remote admin on a failed job you need three things:

- 1) Timestamp when it happened
- 2) Globus job id
- 3) Name of machine you are submitting from.

```
[root@fnpcsrv1 ~]# more
/minos/data/minfarm/condor_log/mca_n13037637_0027_L010185N_D04.0.269
79.1.log
000 (1704008.000.000) 03/16 08:29:19 Job submitted from host:
<131.225.167.44:61501>
017 (1704008.000.000) 03/16 08:30:29 Job submitted to Globus
    RM-Contact: fermigrid1.fnal.gov/jobmanager-condor
    JM-Contact: https://fermigrid1.fnal.gov:49043/28668/1205674220/
    Can-Restart-JM: 1
027 (1704008.000.000) 03/16 08:30:29 Job submitted to grid resource
    GridResource: gt2 fermigrid1.fnal.gov/jobmanager-condor
    GridJobId: gt2 fermigrid1.fnal.gov/jobmanager-condor
https://fermigrid1.fnal.gov:49043/28668/1205674220/
001 (1704008.000.000) 03/16 08:37:55 Job executing on host: gt2
fermigrid1.fnal.gov/jobmanager-condor
012 (1704008.000.000) 03/16 09:19:00 Job was held.
    Globus error 10: data transfer to the server failed
    Code 2 Subcode 10
```

FNAL_GPFARM Condor Pool User Statistics for Month

From Sat Feb 23 12:35:29 CST 2008 to Thu Mar 13 23:42:16 CDT 2008



group_teragrid.nanohub@fnal.gov
JobsRunning
group_numi.minospro@fnal.gov
JobsRunning
group_lic4c.lic4c@fnal.gov
JobsRunning
group_fnalgrid.fnalgrid@fnal.gov
JobsRunning
group_engage.engage@fnal.gov
JobsRunning
group_e898.minboone@fnal.gov
JobsRunning
group_e871.hypercp@fnal.gov
JobsRunning
group_e740.samgrid@fnal.gov
JobsRunning

Configure... Zoom In Zoom Out Reset About

[Graph Hints: The Y-axis is number of jobs, the X-axis is time. When graph finishes updating, press "Configure.." to view different Architecture or State data. Also, you can use the mouse to draw a rectangle on the graph and then press "Zoom In". Press "Reset" to center/resize the data after Configure or when done zooming. Nighttime shows up on graph background as grey.]

User	Total Allocation Time (Hours)	JobsRunning Average	JobsIdle Average	JobsRunning Peak	JobsIdle Peak
Total	121916.2	261.4 (88.9%)	97.5 (11.1%)	810.0 (100.0%)	1194.0 (70.7%)

2.9 0.0 5.0 0.0

Problem diagnosis—Globus Errors

- Globus error 3—I/O error when transferring file
- Globus error 7—authentication, at Fermilab usually a problem with SAZ or GUMS
- Globus Error 10—failure to transfer file, means something is out of quota somewhere.
- Globus Error 12—can't contact the gatekeeper, either it is down or you typed the hostname wrong.
- Globus error 17—either the executable isn't there or there is something wrong with the batch system.
- Globus error 31—failed to cancel the job
- Globus error 93—gatekeeper failed to find the requested service. Probably you requested a jobmanager that wasn't there
- Globus error 155—failure to stage out—happens when proxy expires before end of job
- http://www.cs.wisc.edu/condor/manual/v7.0/Appendix_B_Magic.html

Problem Diagnosis, other errors

```
bash-3.00$ globus-job-run d0cabosgl/jobmanager-condor /usr/bin/id
ERROR: proxy does not exist
Syntax : globus-job-run {[-:] <contact string> [-np N] <executable> [<arg>...]}...
Use -help to display full usage
```

Proxy isn't there. You have to voms-proxy-init

```
Error: Could not establish authenticated connection with the server.
GSS Major Status: Authentication Failed
GSS Minor Status Error Chain:
init.c:globus_gss_assist_init_sec_context:277:
Error during context initialization
init_sec_context.c:gss_init_sec_context:190:
SSLv3 handshake problems
globus_i_gsi_gss_utils.c:globus_i_gsi_gss_handshake:889:
Unable to verify remote side's credentials
globus_i_gsi_gss_utils.c:globus_i_gsi_gss_handshake:862:
SSLv3 handshake problems: Couldn't do ssl handshake
OpenSSL Error: s3_clnt.c:842: in library: SSL routines, function SSL3_GET_SERVER_CERTIFICATE:
certificate verify failed
globus_gsi_callback.c:globus_gsi_callback_handshake_callback:531:
Could not verify credential
globus_gsi_callback.c:globus_i_gsi_callback_cred_verify:729:
Could not verify credential
globus_gsi_callback.c:globus_i_gsi_callback_check_revoked:1031:
Invalid CRL: The available CRL has expired
```

This means that your Certificate Revocation List is old, need to fix.

Problem diagnosis: UPS/UPD, expired proxies

- Avoid setting up UPS/UPD products in a grid job if possible
- UPS/UPD products bring along obsolete versions of perl and python which are not compatible with some grid utilities.
- If proxy expires in mid-job, can still rescue job.
 - condor_q -held shows the error that the proxy is expired
 - Renew your proxy by normal methods
 - Then condor_release the job.

Intro to Globus Web Services

- Globus toolkit is moving from clunky and slow and old perl scripts to clunky and slow and new Java applications.
- Instead of globus-job-run, globusws-run.
- Deployed everywhere on FermiGrid and most of the OSG but the monitoring and information systems haven't caught up yet.
- Old way will stay around for quite a while.
- More web services jobs come later.

Advanced Topics--Lab 5

- Submit sample DAG
- Monitor by using `condor_q` to `fngp-osg`
- If you have a `doegrids` cert, `voms-proxy-init` and submit a job with that.
- Submit a Globus-WS job with `globusrun-ws`
- `globusrun-ws -submit -F fngp-osg.fnal.gov:9443 -s -J -c /usr/bin/id`

End of class

- Be sure to issue the “kdestroy” command to destroy your kerberos credentials on the test machine
- Make sure you filled in an evaluation
- Thanks for coming!
- Further questions can always go to <http://helpdesk.fnal.gov>
- With problem “Grid”, type “Fermilab Sup. Center”, item “FermiGrid”